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Nanostructured Tin Oxide Films: Physical Synthesis, Characterization, and Gas Sensing Properties

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Abstract

Nanostructured tin oxide (SnO₂) films are synthesized using physical method i.e. thermal evaporation and are further characterized with X-ray diffraction, X-ray photoelectron spectroscopy, scanning electron microscopy, transmission electron microscopy, and atomic force microscopy measurement techniques for confirming its structure and morphology. The chemiresistive properties of SnO₂ films are studied towards different oxidizing and reducing gases where these films have demonstrated considerable selectivity towards oxidizing nitrogen dioxide (NO₂) gas with a maximum response of 403% to 100 ppm @200° C, and fast response and recovery times of 4 s and 210 s, respectively, than other test gases. In addition, SnO₂ films are enabling to detect as low as 1 ppm NO₂ gas concentration @200° C with 23% response enhancement. Chemiresistive performances of SnO₂ films are carried out in the range of 1-100 ppm and reported. Finally, plausible adsorption and desorption reaction mechanism of NO₂ gas molecules with SnO₂ film surface has been thoroughly discussed by means of an impedance spectroscopy analysis.

Keywords: Thermal evaporation; Tin oxide, Structure and morphology; NO₂ sensor; Impedance spectroscopy.

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